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# Smart Grid Implementation Support Consultant

# TERMS OF REFERENCE

## 1. BACKGROUND

*<Country background on power sector, demand for electricity, power sector reforms in the country, rationale for the project, government objectives, project history.>*

## 2. OBJECTIVES

*<General Notes: Typical project objectives of an assignment may include the following: sector and strategy studies or assessments, project management and implementation supervision, collection and data analysis, etc.>*

By means of technical assistance objective of this ToR the [donor], intends to support the [country] [power transmission corporation] to refine the existing smart grid tentative road map, define and help [country] [power transmission corporation] perform technical and economic analysis of some priority projects (whose actual implementation will be financed by the [donor]), and define metrics for the success of the road map as a whole and the specific projects to be finances by the [donor]. With this, it is expected that the consultant will bring top-notch state of art knowledge with regard to the application [country] [power transmission corporation] intends to implement and increase their existing capacity to analyze, prepare, execute, and monitor the success of the smart grid activities.

## 3. DELIVERABLES and DESCRIPTION

### Deliverable 1 – Refined smart grid road map strategy document for [country] [power transmission corporation].

Based on the existing national level smart grid road map, and the preliminary road map by the [country] [power transmission corporation] which includes ongoing and future activities. This deliverable should produce a short 20 page document that refines and creates a smart grid roadmap for the [country] [power transmission corporation]. The objective of this report will be to:

1. aggregate in a cohesive manner the actions already under consideration by the [country] [power transmission corporation] and future projects,
2. clearly reaffirm and delineate the vision, pillars of actions, and objective,
3. define some metrics for the overall evaluation of the success of smart grid implementation that could be tied to global policy targets in the sector,
4. identify other areas of opportunity that may have not been identified by the [country] [power transmission corporation], and
5. clearly define phases of implementation as well as indicative projects per phase and pillar of action.

This road map should reflect and priorities of projects as indicated by the [country] [power transmission corporation] assignment.

### Deliverable 2 – Detailed technical and economic assessment of priority smart grid actions to be financed.

The preliminary road map includes many activities, some of which have already been identified as priority:

1. continuation of the substation automation modernization, which includes introduction of the new International Electrotechnical Commission (IEC) standard and modernization of control and protection equipment in various 500 and 200 KV substations,
2. expansion and improvement of the [country] [power transmission corporation] information system, which is SCADA like applications of the monitoring of the grid,
3. increasing capacity of the [country] [power transmission corporation] for testing and maintenance of control, protection, and other equipment,
4. Wide Area Management System (WAMS), Dynamic Line rating, and other applications.

This deliverable will be divided in the following sub-deliverables.

### Sub-deliverable 2.1 - Substation Automation Modernization Projects Technical and Economic Assessment.

The project will select [number] 500 Kv and two 200 Kv substations from the larger set of substations where the substation automation project will be implemented. Based on the information to be provided by the [country] [power transmission corporation] that describe the scope of these four projects.

The consultant will help the [country] [power transmission corporation] prepare final standardized and highest industry standard technical and economic assessment of the project which will include the following aspects:

1. technical due diligence,
2. cost and economic analysis,
3. prepare technical functional specification documents that are ready to bid for the modernization of the substations.

On the technical the consultant should asses the following risk and provide recommendations:

1. inter-operability: to ensure that modernization projects will be able to interact properly with existing and future monitoring, protection, and control components in the system;
2. standards: to ensure that used technologies are well adapted to internationally agreed standards or, where standards are not available, applicable experience is incorporated in the project design;
3. lock-in risks: to ensure that adopted technologies do not face lock-in risks that would compromise future modernization plans for particular technology providers or to adapt quickly to new potential developments.

On the economic side, the consultant should prepare and economic analysis for the [number] selected substations using most up-to-date cost information as well as the collected by the consultant with regard to improvements in performance (reliability, efficiency indicators) for the substations. Of particular importance is that the consultant develops measureable indicators for the performance of the substation modernization program based on available statistics or other that could be recollected by the [country] [power transmission corporation]. These could include failure rates, number of faulty operations by relays, or others.

Based on the experience shared by the consultant will revise and prepare similar technical economic assessment of the other 500 and 220 KV substations that will be modernized as part of the substation modernization component. Based on the [number] substation projects where the consultant will prepare detailed technical en economic analysis, the consultant will prepare overall performance indicators for the substation modernization program. These indicators will be used to indicate the success of the substation modernization smart grid project.

### Sub-deliverable 2.2 - Procurement strategy and functional specifications.

The substation modernization projects include the replacement of various IED such as protections, controls, and other ancillary equipment in the substations. This will include cabling, cabinets, and others.

Given the rapid electricity demand growth is common to see in different substation circuits, transformer or other bays control and protection equipment from different decades. Given that the substation modernization project included mostly existing substations in the different geographical regions of the [country] [power transmission corporation] and which could include substations being managed by [number] different operating areas of the [country] [power transmission corporation] all of which have different technical capacity. For the [number] substations selected the consultant should prepare procurement ready functional specification for the modernization of the [number] substations.

This technical functional specification should be written based on the technical-due diligence above and should follow applicable international and national standards (or other world-wide accepted functional specification guidelines or standard). Based on these [number] samples the [country] [power transmission corporation] is expected to conduct the functional specification of the remaining substations in the program. In addition to preparing the technical functional specification this deliverable should provide a recommendation to the [country] [power transmission corporation] on the best procurement and implementation strategy for the overall substation modernization program, understanding that such a project needs to have strong central coordination in terms of following functional specification and standards, but also need to arrive to a procurement strategy that is efficient from the technical and economic point view.

The procurement and implementation strategy should include the definition of the different contracts and types of contracts to roll-out the implementation and supervision of the substation modernization program. This is the type and number of contracts. If the contracts should be for both supply and installation of equipment, or if they should be independent. In addition the procurement strategy should define the best way to carry the supervision of the substation modernization projects and describe the execution coordination mechanisms between the [country] [power transmission corporation] technical department heard quarters and the regional operating companies within the [country] [power transmission corporation].

### Deliverable 3 - Strategy for implementation of other priority-revised smart grid applications.

The [donor] also intends to support the implementation (either in pilot or full blown form) other smart grid application that considered by the [country] [power transmission corporation] or others that the review of the consultant in Deliverable 1 should be of high potential value to the [country] [power transmission corporation] goals of efficiency, reliability, and the ability of the network to manage renewables.

The objective of this component is to prepare a rapid technical analysis and comments on [number] additional smart grid applications. The analysis should include costing and technical analysis as well as recommendation on the implementation strategy for such application.

Among other applications recommended by the consultant, the applications to be considered for this deliberate are:

1. the extension and upgrade of the information system for the [country] [power transmission corporation],
2. the laboratories to increase the [country] [power transmission corporation] technical capacity to test equipment,
3. a potential pilot implementation of dynamic line ratings, and
4. additional implementation of Wide Area Monitoring.

The latter two are consider of importance given their implication their potential impact on efficiency and the ability of the great to accommodate renewables in the future. Some of these later applications could be considered to be implemented in pilot form. The final [number] application to be detailed in this deliverable will be decided in coordination with the [country] [power transmission corporation] and the [donor] during the definition of the execution of the works.

## 4. WORKING ARRANGEMENTS, TEAMS, and LEVEL of EFFORT

The consultant will report to the Chair of the [country] [power transmission corporation] smart grid working group and the [donor]. The [country] [power transmission corporation] smart grid committee will be chaired by the central technical department of the [country] [power transmission corporation] and will have members from the regional operating companies who operate the substation that will be modernized. The working group could also include other personnel from the [agency in charge of electricity] and the [country] [power transmission corporation]. The working group will be established so that the experience of the consultant, the analysis, and recommendation are passed on to all involved parties within the [country] [power transmission corporation] and so that the tasks are all performed in a coordinated fashion to ensure technical and economic efficiency and consistency.

The consultant is responsible for their internal organization and all trip and logistics arrangements. The [country] [power transmission corporation] and the [donor] will coordinate with the consultant on the specific dates for the trips in the work plan in the next section.

The consultant is expected to form a compact group based on the expertise required by this ToR. It is envisioned that the core team will be of only 2 or 3 experts (substation automation expert, general expert on transmission systems technologies with knowledge of SCADA and other smart grid applications relevant, and an economist/analyst of smart grid investments). It is expected that the core team will be in charge of most (80-90%) of the work depending on their experience, with support from other experts within their firms as considered adequate by the consultant to deliver the task.

The expected level of effort for the task is estimated at 6 man-months total and will include 3 trips to [country] with visits to different substations. Logistics (to and from place of stay) will be provided by the [country] [power transmission corporation]. The consultant is responsible for all other travel arrangements.

## 5. TIMELINE

The consultant is responsible for their internal organization and all trip and logistics arrangements. The [country] [power transmission corporation] and the [donor] will coordinate with the consultant on the specific dates for the trips in the work plan in the next section.

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| **Activity** | **Timeline** |
| Contract signing | Week 0 |
| Kick off workshop and first work trip | Week 2 |
| Draft report (deliverables 1 and 2 only) | Week 6 |
| Second work trip | Week 10 |
| Draft final report (deliverables 1,2,3) | Week 14 |
| Last trip | Week 18 |
| Final report (all deliverables) | Week 20 |